
Feature operation

The rest of this document describes call direction in the context of Meridian 1 Functionality. Incoming calls are calls from the Local Exchange Carrier (LEC) to the IEC (Meridian 1), and outgoing calls are from the IEC to the LEC. Therefore, incoming calls are *calls coming into* the Meridian 1 network.

Example of using the FGD feature

How to initiate a call

Presubscribed user—The case of a presubscribed user assumes prior arrangements have been made to use a specific long distance network or local telephone company (for example SPRINT, MCI, or the carrier being served by the SL-1 with FGD capability). When the user picks up a presubscribed home or work phone and dials a long distance call in the normal way (for example, 1+area code+phone number), the LEC routes that call to the presubscribed carrier for termination over that carrier's network.

Non-presubscribed user—In the case of a non-presubscribed user, the user dials a 5-digit carrier access code (10XXX) before the address digits. This alerts the LEC that this particular call should be routed to the requested long distance carrier for completion. SPRINT, MCI, AT&T, and others have carrier access codes that are recognized by all LECs.

Incoming call routing

Incoming call processing

Call processing of incoming FGD calls is designed to provide maximum flexibility in call routing to external or local DN's.

For call types other than three-digit test calls and operator calls, FGD uses the existing NARS translation table(s). There are usually two translation tables if the NARS package is equipped:

- The first translation table contains routing and other information about NPAs.
- The second translation table contains similar information about NXXs in the home NPA.

NARS accesses these tables by using two different access codes: AC1 and AC2. However, there is no built-in constraint in relating AC1 (or AC2) to the NPA (or NXX) table.

The FGD database identifies the NARS access codes (AC1 or AC2) as being the LDAC (Long Distance Access Code—the one leading to the desired NPA translation table) or the LAAC (Local Area Access Code—the one leading to the NXX translation table).

If the Basic Alternate Route Selection (BARS) and not the NARS package is equipped, then one translation table exists, and the LDAC and LAAC are identical. This could also be true if the NARS package is equipped but only one translation table is configured.

To convert the addressing information obtained from the FGD trunk into a digit sequence that can be processed by NARS, the FGD software prefixes the access code as either LDAC or LAAC.

Incoming FGD calls are processed as follows:

- 1** Digit collecting phase in which all incoming MF digits (ID field and address field) are collected
- 2** Address format validation that checks for valid NPA and NXX and checks that the address fields contain the correct number of digits

The first three digits (or the first four, if the first is a 0) must comply with the following restrictions:

- NPA or NXX, with $2 \leq N \leq 9$, $P=0$ or $P=1$, A or $X = 0$ to 9

An invalid address field leads to call interception, except for the cases in which too many digits are received or no ST is received. In these cases, the MF receiver is released, the trunk is locked out, and no intercept occurs.

- 3** ANI field format validation

The call category determines whether the LEC provides the ANI data.

- 4** II (information digits) screening

The first two digits of the ID field are the II digits. A list of allowed II digits is contained in the FGD block. If the II digits are not defined, the call is intercepted and an error message is (optionally) issued.

- 5** ANI screening (optional)

ANI digits are checked, and an NCOS is attached to the call. In the case of an undefined ANI, call interception can occur, and an error message can (optionally) be issued.

- 6** Address preparation

The address field is retrieved, and one of the NARS access codes is prefixed to it, to make the number conform to the existing Meridian 1 translation tables.

- 7** Translation and termination

The final address is processed by the existing NARS routing.

Local termination

If the FGD call is to be routed to some other node in the network, the NARS feature can make the conversion. The NARS access code is prefixed to the digits; some additional digit manipulation also occurs.

However, the existing NARS feature is not capable of making the conversion if the call terminates on a DN in the local switch that serves as an interface to the LEC using FGD, and full digit conversion (more than four digits) is required.

In this case, the Local Termination (LTER) entry in the NARS route list block is used for local translation, and is not related to any trunk group. The LTER entry may appear in any route list and can be accessed when route selection takes place. The existing restriction facilities, which include TOD (Time Of Day schedule), FRL, and FCAS, can be applied as usual.

When an LTER entry is selected, NARS considers it a success, regardless of the result of the termination (busy, vacant number). When the LTER entry is not restricted by the facilities mentioned above, the entries following it in the route list will never be selected.

Calls inside World Zone 1 (7 digits)

These calls are characterized by an address field of seven digits. The Meridian 1 inserts the NARS LAAC access code before the address field.

Calls inside World Zone 1 (10 digits)

These calls are characterized by an address field of 10 digits. The Meridian 1 inserts the NARS LDAC access code before the address field, thus allowing routing of the call within the corporate network.

Calls inside World Zone 1 (0+ and 0-)

A call to the operator is distinguished by a digit sequence in which the first digit of the address field is 0.

The address field dialed by the incoming FGD trunk should use one of the following sequences:

- 0+ type call: KP + 0 + (NPA) + NXX + XXXX + ST
- 0+ type call: KP + 0 + SAC + NXX + XXXX + ST
- 0- type call: KP + 0 + ST

An operator DN (or up to 16 digits) is defined through a Service Change (SCH) and all “0-” and “0+” calls are directed to this DN. This can be either the local attendant DN or any DN in the network.

During call processing in the address preparation, the address field received from the FGD trunk is replaced with the operator DN described above. The call is then processed by the DN translation tables.

An option is provided to intercept all “0+” and “0-” calls to a Recorded Announcement Trunk route.

An address field sequence beginning with 0, but followed by an incorrect number of digits, or containing an invalid NPA, will lead to call intercept (invalid address format). In addition, the rest of the address field that follows the “0” is ignored.

Table 11 provides an example of a “0+” call.

Table 11
 EANA protocol: customer dials 10XXX+0

Situation		
Customer dials 10990+0		
Trunk group uses Exchange Access North American (EANA) signaling protocol		
Interface interactions		
LEC	POT	Meridian 1
Customer finishes dialing		
Seize	----->----- -----<-----	Wink
Identification field KP+0+212+555+XXXX+ST	----->-----	
Address Field KP+0+ST	----->----- -----<-----	Acknowledgment wink
LEC connects talking path		
Disconnect	-----<----- ----->----- -----<-----	Answer Disconnect
Interpretation		
Class of service of calling line is regular (II=00).		
Billing number of calling line is 212+555+XXXX.		
Customer did not provide a destination address.		

Information digits screening for incoming calls

The FGD feature allows flexible II type assignment. **Table 12** shows the II digits defined as defaults. The interpretation of the various II codes (00–99) is defined by the customer through service changes. The flexibility is per route: the customer defines independent FGD blocks (up to 128) containing the II definitions, then specifies one block index for each FGD route. Each number in the 00–99 range can be defined as pertaining to one of the II-types listed in **Table 12**. Numbers in the 00–99 range that have not been defined are considered denied.

Table 12
Information digits (II)

Information digits	Explanation
00	Regular line
01	4- and 8-party
06	Hotel/Motel
07	Coinless
10	Test call
12–19	Not assigned because of conflicts with 1NX used as first digits in international calls
20	AIOD listed directory number sent
27	Coin
95	Test Call

Information digit pairs 10, 12–19, and 95 are not generated as ANI information digits by LEC originating end offices.

Because the identification field precedes the address field for exchange access signaling, and because there is no identification field on test calls, the first two digits of the address field for test calls appear to the carrier as ANI information digits. Either a 10 or a 95 in this position tells the carrier that the incoming call is a test call.

Digits 12 to 19 are used for calls outside World Zone 1. These are not used by EANA.

In addition, an Network Class of Service (NCOS) number may be attached to an II. This allows it to bypass ANI screening. If an II has an NCOS attached to it, then

- ANI screening will not be done on calls initiated by customers with II.
- The incoming FGD trunk will have the NCOS stated above.

In the II processing phase, the information related to the call type is retrieved from the FGD block. If intercept treatment is needed (for the invalid II case), intercept treatment is applied as defined for “invalid II.”

FGD call intercept

Intercept treatment is supplied for the following invalid calls:

- Invalid address field format
- Invalid II
- Invalid ANI

The intercept treatment for each of these calls can be defined by Service Change to be Overflow Tone (OVF), a Recorded Announcement (RAN), or termination on a network or local DN.

Incoming test calls (3 and 7 digits)

The line testing facilities currently provided by Meridian 1 to incoming trunks are:

- A 100 test termination DN for simultaneous access by up to four trunks. There is one 100 test termination DN per customer.
- Four pairs of reference trunk termination DNs and test trunk termination DNs.

A test call digit sequence is a 3-digit or 7-digit sequence of the form 10X (3 digits) or 95Y-XXXX (7 digits), where Y is either 8 or 9 (the 10 and 95 prefixes may be modified by service change). There is no identification field; therefore, digits 10 or 95 appear to the carrier as an II code (information digits). The processing after the II type has been identified as a test call type is described below. Also refer to the section **“Information digits screening for incoming calls” on page 39.**

In the FGD blocks, there are actually two types of test call information digits (II):

- TST3, typically digits 10
- TST7, typically digits 95

In the remainder of this section, reference may be made to either TST3 or TST7, or to their corresponding digits 10 and 95.

The two types of call information are treated differently:

- **10X calls** are interpreted as calls to the T100-line test DN.
- **95Y calls** are routed via NARS/BARS using the LAAC access code.

The possible situations are

- Digits KP + 10X + ST are received on an incoming FGD trunk:
 - 100 is dialed (X=0); it triggers the T100 line test. Normally an incoming tie dials the T100-line test DN. If X is not 0, the call receives an invalid address treatment.
 - Digit sequences starting with 10 but not containing three digits lead to call intercept (invalid address format).
- Digits KP + 95Y + XXXX + ST are received on an incoming FGD trunk.
 - The whole number is treated as an address: The LAAC access code is inserted, invoking NARS/BARS translation. The call can be forwarded to the network or handled by local test equipment.
 - Digit sequences starting with 95 but not containing seven digits invoke a call intercept (invalid address format).

Authorization Code prompting

FGD routes may be defined to prompt for Authorization Code.

An NCOS is attached to an incoming FGD trunk by one of the following:

- If ANI screening is bypassed, an NCOS is associated with the II type.
- If ANI screening is configured, an NCOS is defined by the ANI screening process.
- The NCOS of the call is the NCOS of the FGD trunk.

LEC trunk grouping and ANI provision by call category

LEC trunk grouping

Calls intended to terminate on an IEC POT can be assigned by the LEC to different trunk groups (for example, trunk routes) according to their category and the class of service (for example, II type) of the calling customer. Up to four such groups may exist.

On the Meridian 1, the FGD block associated with an FGD trunk route contains data regarding the call categories expected. A service change can modify this data to conform to the agreement between the LEC and the IEC. This data, together with the II screening data, serves to verify correct trunk grouping as agreed to with the LEC.

The appropriate error message is issued when a call of an unexpected category reaches the IEC. **Table 1** contains a list of call categories.

An IEC switch cannot distinguish between the following two categories:

- Embodied SAC calls
- External SAC calls

If one of them is expected, all SAC calls are considered expected. Test calls are considered expected.

ANI provisions

ANI digits are provided by the LEC based on call category according to the agreement with the IEC.

The FGD block associated with an FGD trunk route determines whether ANI data is to be received on such a call.

Note: ANI data is never received on test calls.

An error message is issued when

- ANI is *not* received on a call when expected.
- ANI is received on a call when *not* expected.

ANI digits screening

This section describes the screening function to be performed on the ANI digits in an identification field.

After the complete digit string (both identification and address fields) is collected, and the call passes the II (information digits) screening, the ANI bypass option is attached to the call's information digits.

If ANI screening is not configured, the call proceeds with the NCOS of the incoming trunk. Otherwise, the following ANI screening is performed.

If the ANI provision is selected by the IEC, the ANI digits are normally 10 digits (or three digits when the calling party cannot be identified).

- NPA+NXX+XXXX (normal case)
- NPA (calling party not identified)

Calls with associated ANI digits from FGD trunks are screened against the ANI database as defined in the Meridian 1 access node.

For each allowed (or recognized) NPA, ANI screening is defined in three levels:

- NPA (3 digits)
- NPA+NXX (6 digits)
- NPA+NXX+XXXX (10 digits)

Each valid ANI is associated with a specific NCOS, which is the calling party's initial NCOS, to be used for determining call termination through Electronic Switched Network (ESN).

10 ANI digits

If the 10 ANI digits (NPA+NXX+XXXX) are received from an incoming FGD trunk, call validation is based on the screening level defined in the ANI database:

- NPA (3 digits) screening level

The received ANI digits NPA must match a defined area code in the database.

- NPA+NXX (6 digits) screening level

The received ANI digits NXX must be within the defined end office number range under the NPA.

- NPA+NXX+XXXX (10 digits) screening level

The received ANI digits XXXX must be within the defined subscriber number range under the NPA+NXX.

A match yields an NCOS to be used later for called number screening and routing. Otherwise, invalid ANI treatment is applied.

Partial ANI digits

If only three ANI digits (NPA) are received from an incoming FGD trunk and:

- The NPA is defined in the ANI database (regardless of the screening level defined):
 - 3-digit ANI allowed—*Pass*: extract the specified NCOS.
 - 3-digit ANI not allowed—*Fail*: apply invalid ANI treatment.
- The NPA is not defined in the ANI database—*Fail*: apply invalid ANI treatment.

Invalid ANI treatment

Possible invalid ANI treatments include routing to Overflow Tone (OVF), Recorded Announcement (RAN), or a network or local DN or considering it as passed and mapping it to an NCOS that is specified for invalid ANI.

ANI digits as Calling Line ID (CLID)

If an incoming FGD call is routed to a neighboring switch via an ISDN PRI or ISL, the complete 10-digit ANI is used as the Calling Line ID (CLID). It is then sent (in a SETUP message) to the neighboring switch for CLID display. An incomplete 3-digit ANI is not treated as a CLID.

If the SHAN field of the FGD data block associated with the incoming route indicates that the ANI should not be displayed on the terminating telephone, the ANI is still sent over the ISDN PRI or ISL as the CLID. However, the presentation indicator field of the calling party number information element is set to presentation restricted, so the CLID is not displayed on the terminating telephone.

ANI display

For FGD calls terminating in the local switch, the received ANI number is displayed instead of the route access code and member number as is currently displayed for a trunk call. The option is per FGD block.

The implementation of this capability does not modify the operation of the existing Digit Display feature.

The formats of the received ANI number are:

- KP + II + 10 + ST. The display is the 10-digit string.
- KP + II + 3D + ST. The display is the route access code and member number.
- KP + ST (no ANI). The display is the route access code and member number.

The rules and limitations of the Digit Display feature are used.

The ANI display for FGD has the same format and interactions with other features as the CLID display of an E.163 number (as opposed to a private network number).

ANI number display devices

The following devices support ANI number display:

- QCW4, M1250, and M2250 attendant consoles
- SL-1 display telephone
- M3000
- M2009, M2018, M2018S, M2112, and M2317
- M2006, M2008, and M2016S
- M2216ACD-1 and M2216ACD-2
- M2616

Dial pulse dialing on FGD trunks

Dial Pulse (DP) outpulsing on trunks is not allowed on either incoming or outgoing FGDT trunks.

Outgoing test calls

Outgoing test calls are generated by

- dialing the FGD route access code from a Meridian 1 station and a test number consisting of three or seven digits
- dialing the TVS access sequence from a Meridian 1 station to select a specific FGD trunk. For example, dial a special prefix DN, plus the Trunk Verification from a Station (TVS) special function code, plus the route access code, plus the trunk member number, and a test number (three or seven digits).
- dialing automatically from the Automatic Trunk Maintenance overlay (test numbers must contain either three or seven digits)

CDR records

The CDR records for calls in which an incoming FGD trunk was involved can (optionally) include an ANI digits field. The option is per route, defined in its FGD block. To include the ANI digits field requires the Call Detail Recording Expansion (CDRE) package.

For a detailed discussion of CDR output, see *Call Detail Recording description and formats* (553-2631-100).

Transmission characteristics

For the purposes of transmission losses and gains, FGD trunks are treated as tie trunks: analog FGD trunks have PTYP = ATT (port type in LD 16) and digital FGD trunks have PTYP = DTT. These values are imposed by Service Change when defining an FGDT route. In a connection between an analog FGDT trunk and a PRI channel, the PRI channel is treated as a digital tie (DTT), overriding the definition for PRI channels.

Operating parameters

Parameters

The maximum number of Multi-Frequency Receivers (MFRs) that can be defined in the Meridian 1 system is 255.

The maximum number of FGD blocks that can be defined in the Meridian 1 system is 128.

An FGD route can be configured as a DNIS route. In this situation, the route should carry ACD calls only.

FGD trunks will use MF signaling only to establish a call. Dual Tone Multifrequency (DTMF) signaling can be used for in-band signaling after establishing an end-to-end connection. For example, it can be used for Authorization Code entry.

Terminating protocol is limited to test calls only.

FGD is available on all machine types supported by X11 release 17 and later. However, the available Protected Data Store (PDS) and disk storage is limited to the maximum amount of FGD data, particularly ANI data, that can be configured for a given machine type.

For system option 21 and SL-1 ST, the theoretical maximum is 64K words, and, if FGD ANI shares the same physical page with other features, the actual PDS available for FGD ANI is much smaller. For other systems, there is virtually no limit (approximately 2 million words).

The linear and cyclic search methods supported by Meridian 1 are acceptable for FGD trunks.

Transitional configurations

On a transitional basis, if full Meridian 1 support is not available for FGD, systems with Meridian 1 hardware can have non-Meridian 1 MFRC in a non-Meridian 1 peripheral shelf installed (together with non-Meridian 1 PE buffer) in a Meridian 1 cube with Meridian 1 power supply. In that case, MF tone receiving is performed by QPC916 receivers only, whereas MF sending can be performed by both MF loops and/or Conference/TDS cards.

MF Receiver guidelines

The MF Receiver (MFR) receives 26 MF digits from the Equal Access End Office. Holding time for the MF Receiver is estimated at 13 seconds (about 0.5 seconds per digit). When the number of MF trunks are known, the following procedures can be used to estimate the MFR requirements:

- Calculate the number of FGD calls from MF trunks. For example, with 30 CCS per trunk and 180 seconds holding time assumed:

FGD calls (FGDC) = # of MF trunks * 30 * 100/180 = 16.67 * # of MF trunks

- Calculate MFR traffic. For example, with 13 seconds receiver holding time assumed:

MFR traffic in CCS = FGDC * 13/100

Refer to [Tables 13, 14, and 15](#) to determine the number of MFRs to support your system.

[Table 13](#) provides information on multifrequency receiver load capacity with 6 to 15 second holding times.

[Table 14](#) provides information on the multifrequency receiver load capacity with 16 to 25 second holding times.

[Table 15](#) provides the multifrequency receiver requirements with the Poisson 0.1 percent blocking information.

Table 13
Multifrequency receiver load capacity: 6 to 15 second holding time (Part 1 of 2)

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number of MFR										
1	0	0	0	0	0	0	0	0	0	0
2	3	2	2	2	2	2	2	2	2	2
3	11	10	10	9	9	9	9	8	8	8
4	24	23	22	21	20	19	19	19	18	18
5	41	39	37	36	35	34	33	33	32	32
6	61	57	55	53	52	50	49	49	48	47
7	83	78	75	73	71	69	68	67	66	65
8	106	101	91	94	91	89	88	86	85	84
9	131	125	120	116	113	111	109	107	106	104
10	157	150	144	140	136	133	131	129	127	126
11	185	176	170	165	161	157	155	152	150	148
12	212	203	196	190	185	182	178	176	173	171
13	241	231	223	216	211	207	203	200	198	196
14	270	259	250	243	237	233	229	225	223	220
15	300	228	278	271	264	259	255	251	248	245
16	339	317	397	298	292	286	282	278	274	271
17	361	346	335	327	310	313	319	306	392	298
18	391	377	365	356	348	342	336	331	327	324
19	422	409	396	386	378	371	364	359	355	351
20	454	438	425	414	405	398	393	388	383	379
21	1487	469	455	444	435	427	420	415	410	406
22	517	501	487	475	466	456	449	443	438	434

Table 13
Multifrequency receiver load capacity: 6 to 15 second holding time (Part 2 of 2)

Average holding time in seconds	6	7	8	9	10	11	12	13	14	15
Number of MFR										
23	550	531	516	504	494	487	479	472	467	562
24	583	563	547	535	524	515	509	502	497	491
25	615	595	579	566	555	545	537	532	526	521
26	647	628	612	598	586	576	567	560	554	548
27	680	659	642	628	618	607	597	589	583	577
28	714	691	674	659	647	638	628	620	613	607
29	746	724	706	690	678	667	659	651	644	637
30	779	758	738	723	709	698	690	682	674	668
31	813	792	771	755	742	729	719	710	703	696
32	847	822	805	788	774	761	750	741	733	726
33	882	855	835	818	804	793	781	772	763	756
34	913	889	868	850	836	825	812	803	795	787
35	947	923	900	883	867	855	844	835	826	818
36	981	957	934	916	900	886	876	866	857	850
37	1016	989	967	949	933	919	909	898	889	881
38	1051	1022	1001	982	966	951	938	928	918	912
39	1083	1055	1035	1015	999	984	970	959	949	941
40	1117	1089	1066	1046	1029	1017	1002	990	981	972
Note: Load capacity is measured in CCS.										

Table 14
Multifrequency receiver load capacity: 16 to 25 second holding time (Part 1 of 2)

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number of MFR										
1	0	0	0	0	0	0	0	0	0	0
2	2	2	2	2	2	2	2	2	2	2
3	8	8	8	8	8	8	8	8	8	8
4	18	18	18	18	18	17	17	17	17	17
5	31	31	31	30	30	30	30	30	30	29
6	47	46	46	45	45	45	45	44	44	44
7	64	63	63	62	62	62	61	61	61	60
8	83	82	82	81	80	80	79	79	79	78
9	103	102	101	100	100	99	99	98	98	97
10	125	123	122	121	121	120	119	119	118	118
11	147	145	144	143	142	141	140	140	139	138
12	170	168	167	166	165	164	163	162	161	160
13	193	192	190	189	188	186	185	184	184	183
14	218	216	214	213	211	210	209	208	207	206
15	243	241	239	237	236	234	233	232	231	230
16	268	266	264	262	260	259	257	256	255	254
17	294	292	290	288	286	284	283	281	280	279
18	322	319	317	314	312	311	309	308	306	305
19	347	344	342	339	337	335	334	332	331	329
20	374	371	368	366	364	361	360	358	356	355
21	402	399	396	393	391	388	386	385	383	381
22	431	427	424	421	419	416	414	412	410	409

Table 14
Multifrequency receiver load capacity: 16 to 25 second holding time (Part 2 of 2)

Average holding time in seconds	16	17	18	19	20	21	22	23	24	25
Number of MFR										
23	458	454	451	448	445	442	440	438	436	434
24	486	482	478	475	472	470	467	465	463	461
25	514	510	506	503	500	497	495	492	490	488
26	544	539	535	532	529	526	523	521	518	516
27	573	569	565	561	558	555	552	549	547	545
28	603	598	594	590	587	584	581	578	576	573
29	631	626	622	618	614	611	608	605	602	600
30	660	655	651	646	643	639	636	633	631	628
31	690	685	680	676	672	668	665	662	659	656
32	720	715	710	705	701	698	694	691	688	686
33	751	745	740	735	731	727	724	721	718	715
34	728	776	771	766	761	757	754	750	747	744
35	813	807	801	796	792	788	784	780	777	774
36	341	835	829	824	820	818	814	810	807	804
37	872	865	859	854	849	845	841	837	834	831
38	902	896	890	884	879	875	871	867	863	860
39	934	927	921	914	909	905	901	897	893	890
40	965	952	952	945	940	936	931	927	923	920
Note: Load capacity is measured in CCS.										

Table 15
Multifrequency receiver requirements: Poisson 0.1 percent blocking

Number of MFR	MFR load (CCS)	Number of MFR	MFR load (CCS)	Number of MFR	MFR load (CCS)
1	0	18	276	35	703
2	2	19	299	36	729
3	7	20	323	37	756
4	15	21	346	38	783
5	27	22	370	39	810
6	40	23	395	40	837
7	55	24	419	41	865
8	71	25	444	42	892
9	88	26	469	43	919
10	107	27	495	44	947
11	126	28	520	45	975
12	145	29	545	46	1003
13	165	30	571	47	1030
14	187	31	597	48	1058
15	208	32	624	49	1086
16	231	33	650	50	1115
17	253	34	676		